

Step 1: Create Copper Traces

Time to create a path for our electricity with copper tape. Each template has icons to help guide you in constructing the circuit.



Line A

Take a look at the template and find the circle marked A. Peel away a few inches of the paper backing from the copper tape and stick down along the grey line.



Cut when you reach the scissors icon.

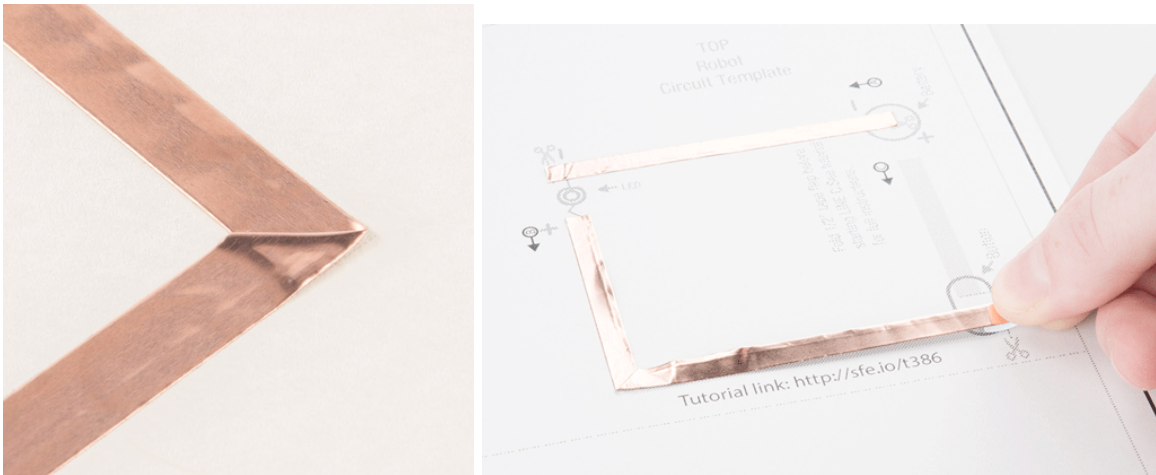
Line B

Next we'll place tape along Line B which includes a corner. To keep a solid connection of copper around corners, we'll be using a folding technique to press the tape into shape.

Start by sticking the copper tape down until you reach the corner, then fold the tape backward on itself. Use a fingernail or pen to give it a good crease at the edge.



Then carefully move the tape down around the corner - you should see the fold forming - and press down flat against the paper. The neatness of the fold doesn't matter that much, it will be covered by your pop up in the end. Finally, cut the tape when you reach the scissors icon.



Line C

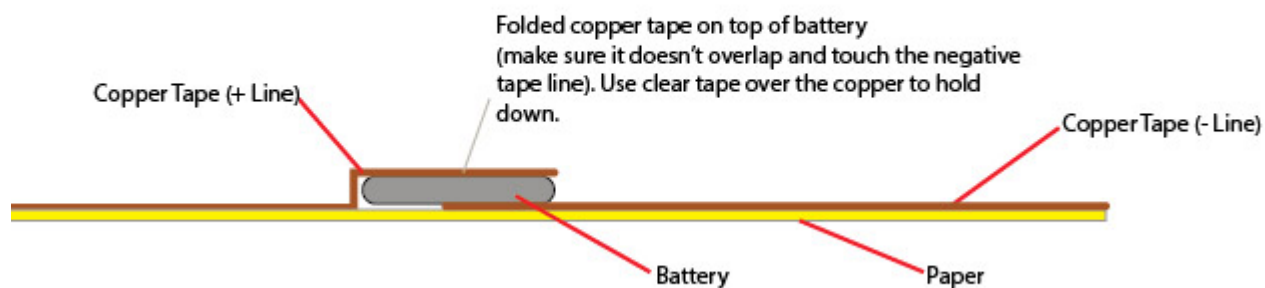
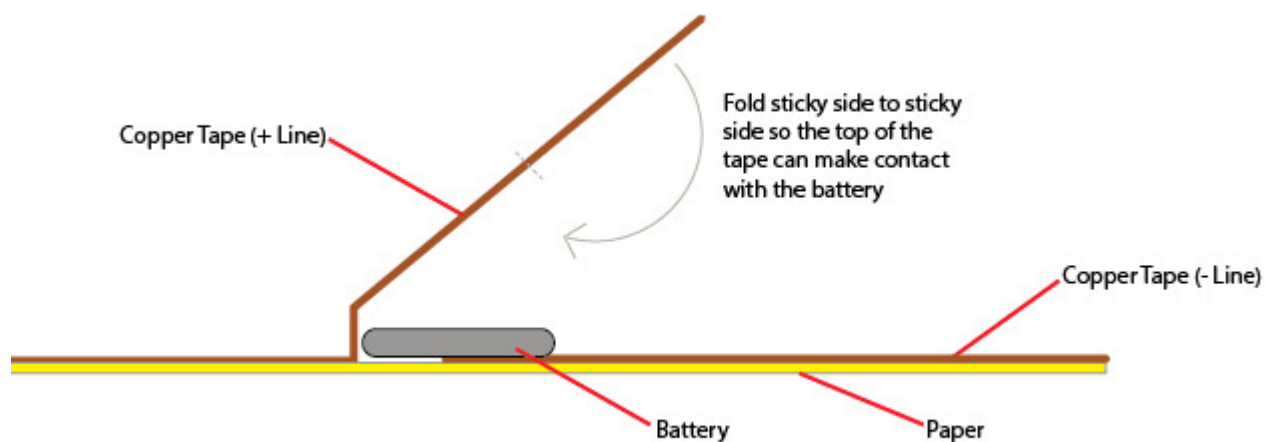
The last copper tape line will also form a battery holder. We'll start by folding $\frac{1}{2}$ " of copper tape onto itself, sticking the adhesive sides together to form a flap.



This allows the top of the copper to fold down over the coin cell battery - the positive side of the battery is the top and negative side is the bottom, which allows us to create a 'battery sandwich' with copper tape touching each side.



See the diagrams below to explore how this method works. We won't be installing the battery until the end of our project, so set that aside for now. Fold the card in half along the dotted center line before moving onto the next step.



Step 3: Prepare and Place LED

Before prepping the LED, fold the card in half along the dotted line to save the hassle of trying to make a neat fold once there are components sticking up from the paper.

Now that our copper is in place, time to add the LED. The template has an LED symbol which shows shaped wires - we use this method to help us remember which side is positive and negative on the LED.

Here are directions for bending a 3mm LED to prepare it for our circuit.

Note: the cycling RGB LEDs have a clear bulb - we used a yellow LED for these photos.

Using your finger, bend the longer leg of the LED flat and then form into a zig zag shape. Be careful not to break the wire by bending back and forth over the same joint too many times.



Next, bend the other leg flat and curl into a spiral. Use the end of the pliers to lightly grab the end of the wire and curl around the tool.



Once all shaping is complete, place the LED on a table or flat surface to make sure it sits flat and upright. If not, make any adjustments now.

Tape Down LEDs

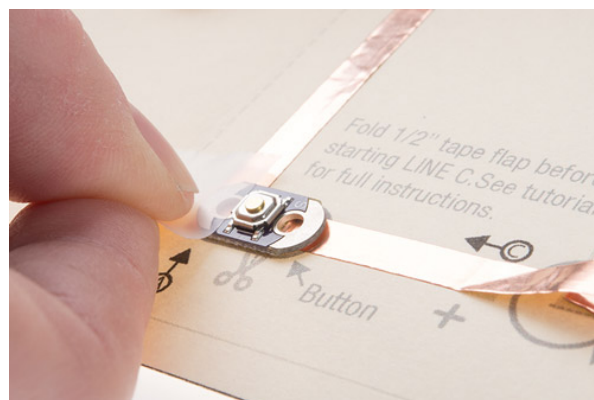
Line up the positive lead with the copper tape marked + and the negative with -. Use clear tape over the leads to hold down to the copper.



Step 4: Attach Button



Next, we'll place the LilyPad button over the oval icon on the template facing up. It doesn't matter which side touches positive and negative. Make sure the conductive pads on the bottom of the button touch the copper tape, then tape down the ends with clear tape. Be careful not to tape directly over the push part of the button, or it may interfere with the ability to press it.

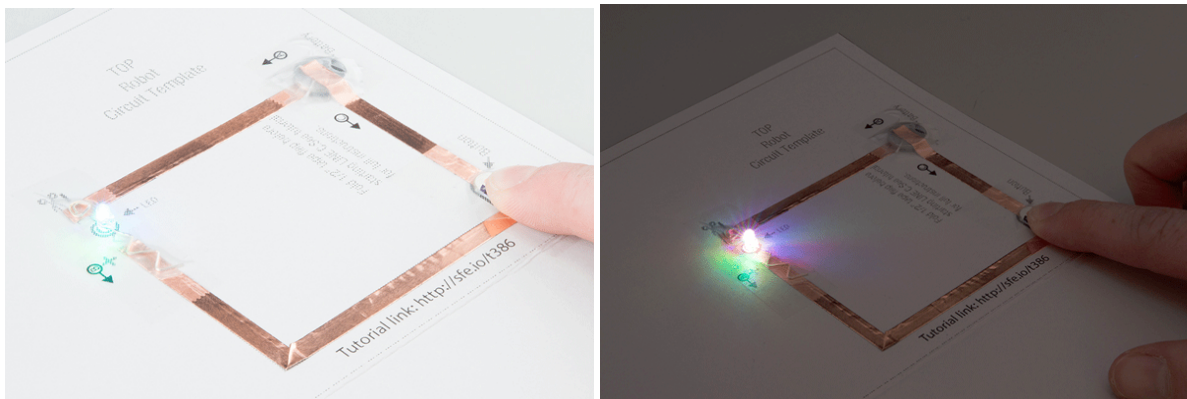


Step 5: Insert Battery

Once all the components are installed, it's time to test our circuit by adding a battery. Carefully slip the battery underneath the copper tape flap we made earlier, and center it inside the circle icon. Make sure the positive side of the battery (top, marked with the battery model and +) is facing up. Press the copper over the battery, and tape with clear tape.



Now, press the button, and the LED should light up!

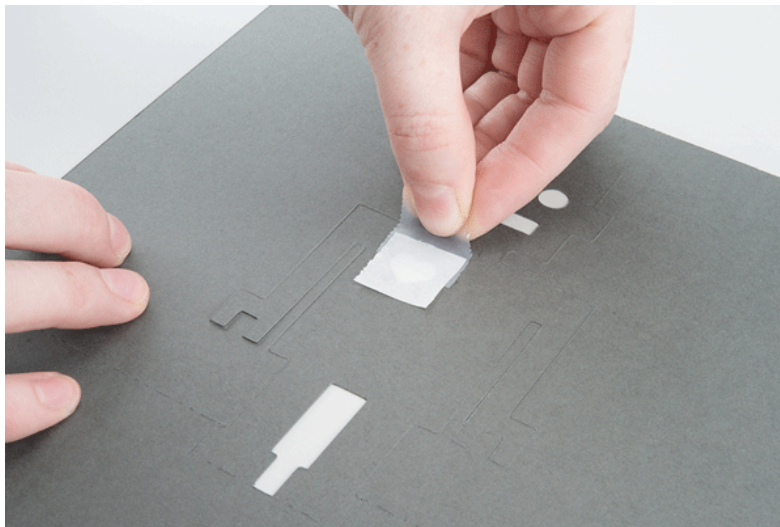


Troubleshooting

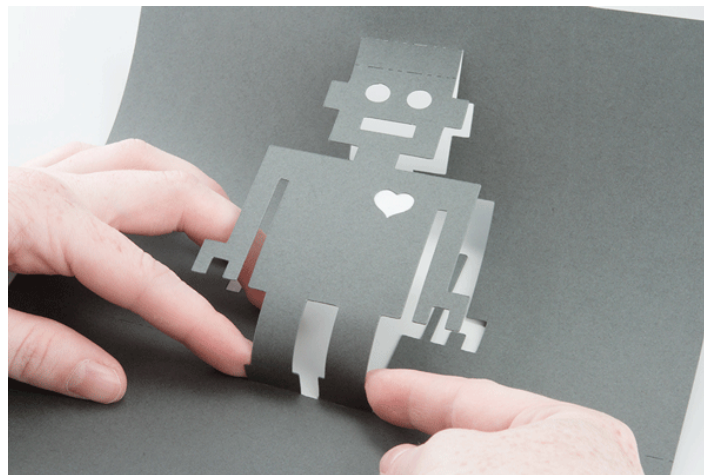
- Check the tape connections - use your nails or a pencil to make sure the tape is firmly adhering the components to the copper tape.
- Check the battery - make sure it is sandwiched firmly between the top and bottom copper tape lines and that the top copper is not accidentally touching the bottom of the battery.
- Check the wires of the LED - double check that they weren't accidentally broken while bending them into shapes with pliers.

Step 6: Prepare Pop Up

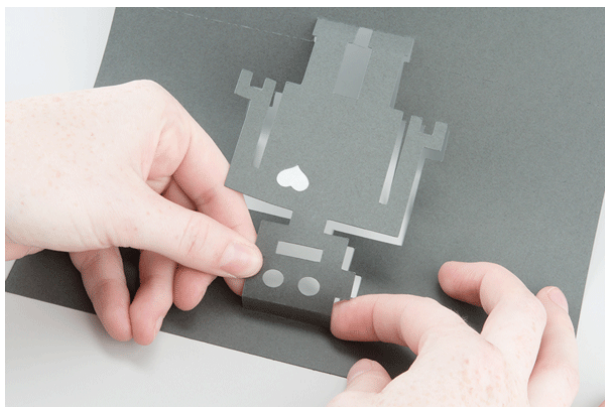
Use a hobby knife to cut along the lines of the pop up template. Tape or glue a piece of vellum or a semi-transparent paper to the back of robot over the heart to diffuse the light from the RGB LED.



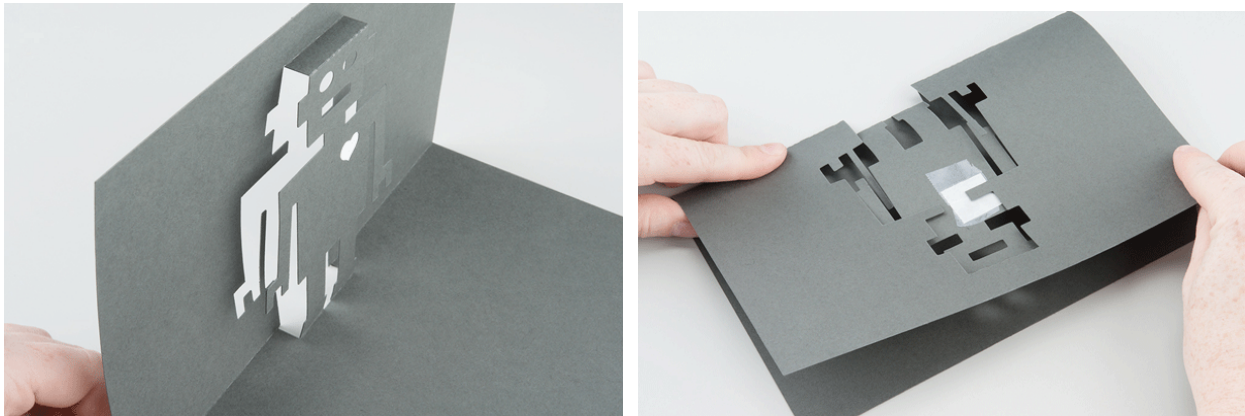
To pop the robot up from the page, first turn paper over to the front side (the heart should be on the right side of the robot). Carefully fold the robot's feet toward you.



Rotate the card so the robot's head is facing you and crease the top fold toward you and second fold away from you.



To finish the pop up, fold the card in half - making sure not to accidentally fold the legs. The robot should fold up neatly in the card.



To attach to your circuit, place the robot pop up page over the copper tape circuit and adjust as necessary so the LED shines through the robot's heart. Trim edges if needed and use glue or tape to fix the corners down. Be careful not to glue under the pop up pieces or they may stick down when closed.

Step 7: Decorate and Customize

After assembling, use a marker or stickers to indicate where the button should be pressed on the top layer. Add extra decorations and embellishments to make your project unique!